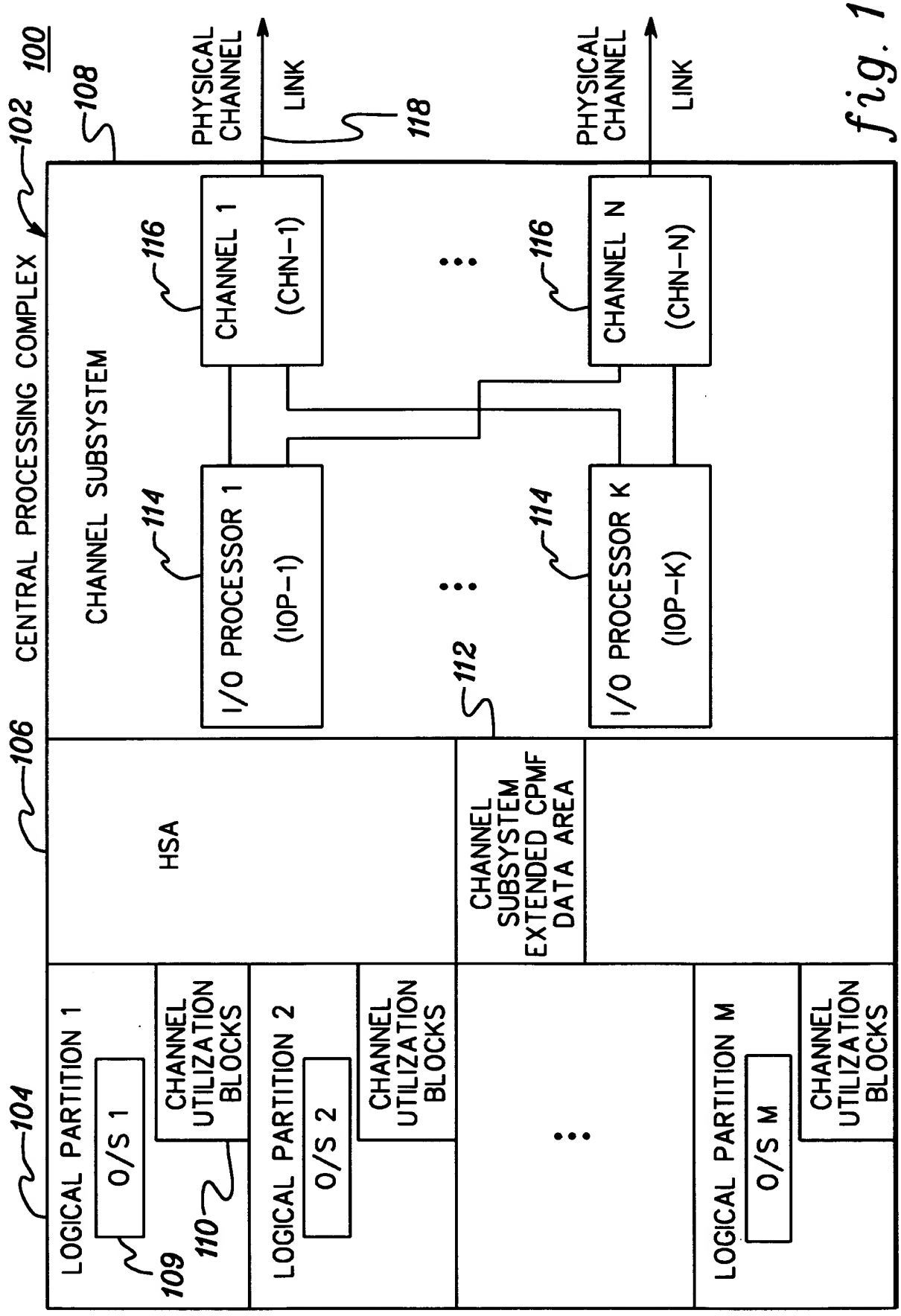
100
CENTRAL PROCESSING COMPLEX
102
108
PHYSICAL CHANNEL
LINK
118
PHYSICAL CHANNEL
LINK
CHANNEL SUBSYSTEM
116
CHANNEL 1 (CHN-1)
116
CHANNEL N (CHN-N)
114
I/O PROCESSOR 1 (IOP-1)
114
I/O PROCESSOR K (IOP-K)
112
106
HSA
CHANNEL SUBSYSTEM EXTENDED CPMF DATA AREA
104
LOGICAL PARTITION 1
O/S 1
109
CHANNEL UTILIZATION BLOCKS
110
LOGICAL PARTITION 2
O/S 2
CHANNEL UTILIZATION BLOCKS
LOGICAL PARTITION M
O/S M
CHANNEL UTILIZATION BLOCKS

fig. 1

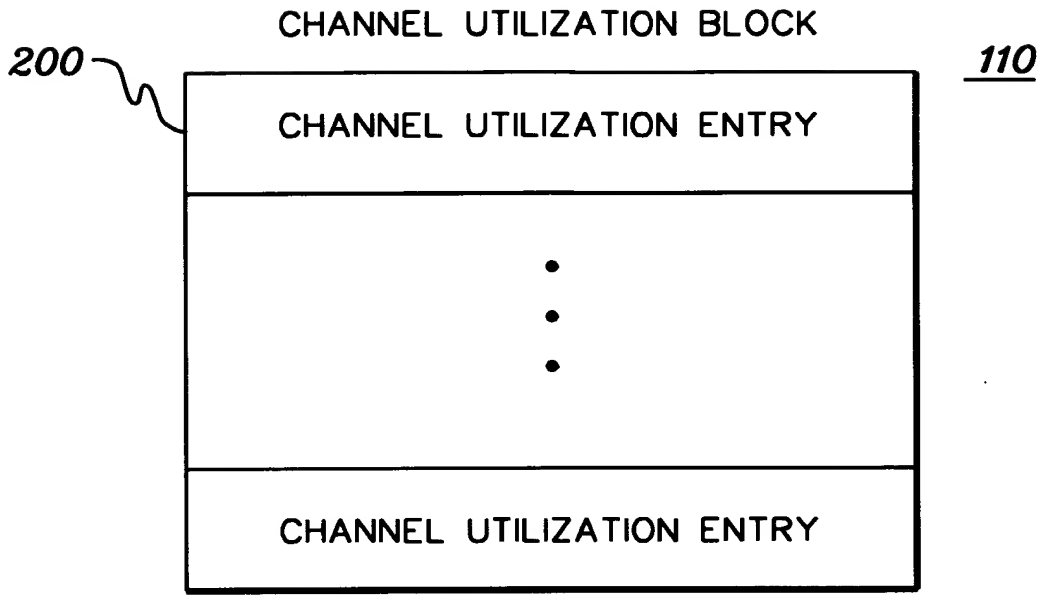
CHANNEL UTILIZATION BLOCK
200
110
CHANNEL UTILIZATION ENTRY
CHANNEL UTILIZATION ENTRY

fig. 2A

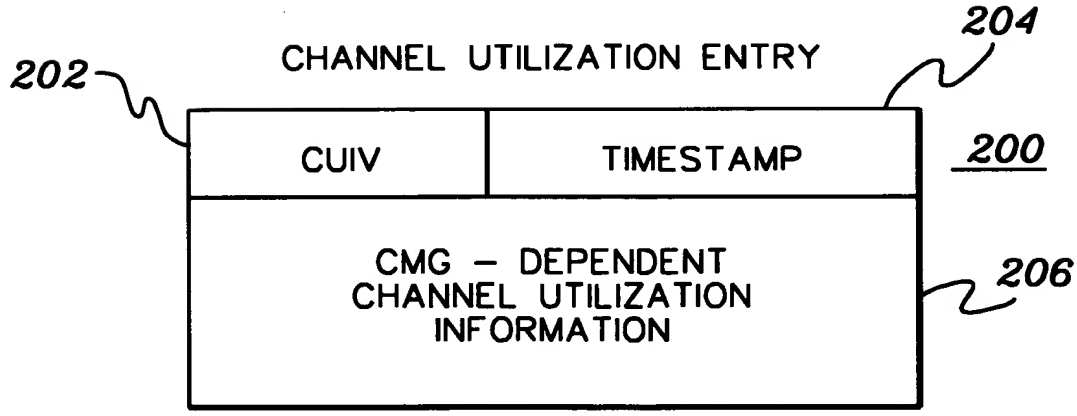
202
CHANNEL UTILIZATION ENTRY
204
CUIV
TIMESTAMP
200
CMG – DEPENDENT
CHANNEL UTILIZATION
INFORMATION
206

fig. 2B

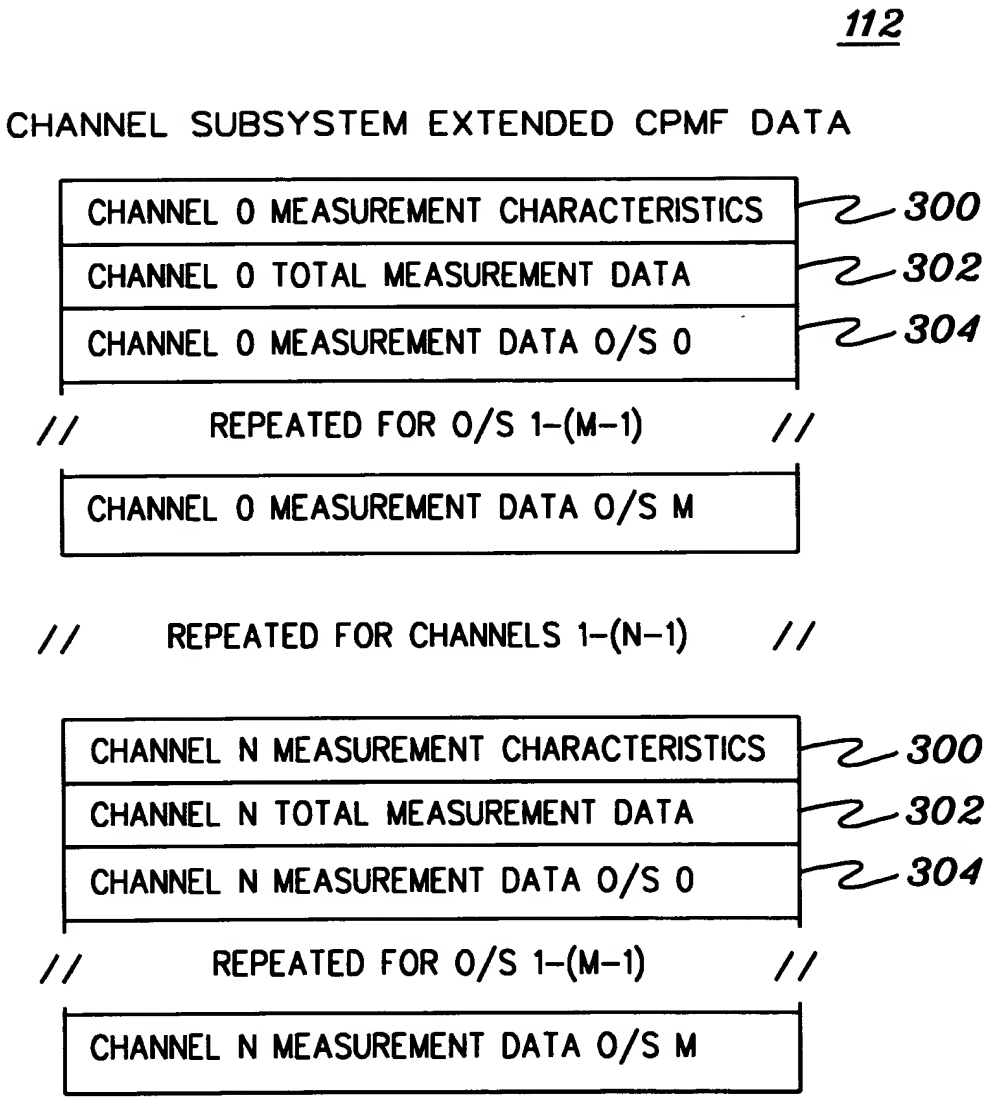
112
CHANNEL SUBSYSTEM EXTENDED CPMF DATA
CHANNEL 0 MEASUREMENT CHARACTERISTICS
300
CHANNEL 0 TOTAL MEASUREMENT DATA
302
CHANNEL 0 MEASUREMENT DATA 0/S 0
304
// REPEATED FOR 0/S 1-(M-1) //
CHANNEL 0 MEASUREMENT DATA 0/S M
// REPEATED FOR CHANNELS 1-(N-1) //
CHANNEL N MEASUREMENT CHARACTERISTICS
300
CHANNEL N TOTAL MEASUREMENT DATA
302
CHANNEL N MEASUREMENT DATA 0/S 0
304
// REPEATED FOR 0/S 1-(M-1) //
CHANNEL N MEASUREMENT DATA 0/S M

fig. 3

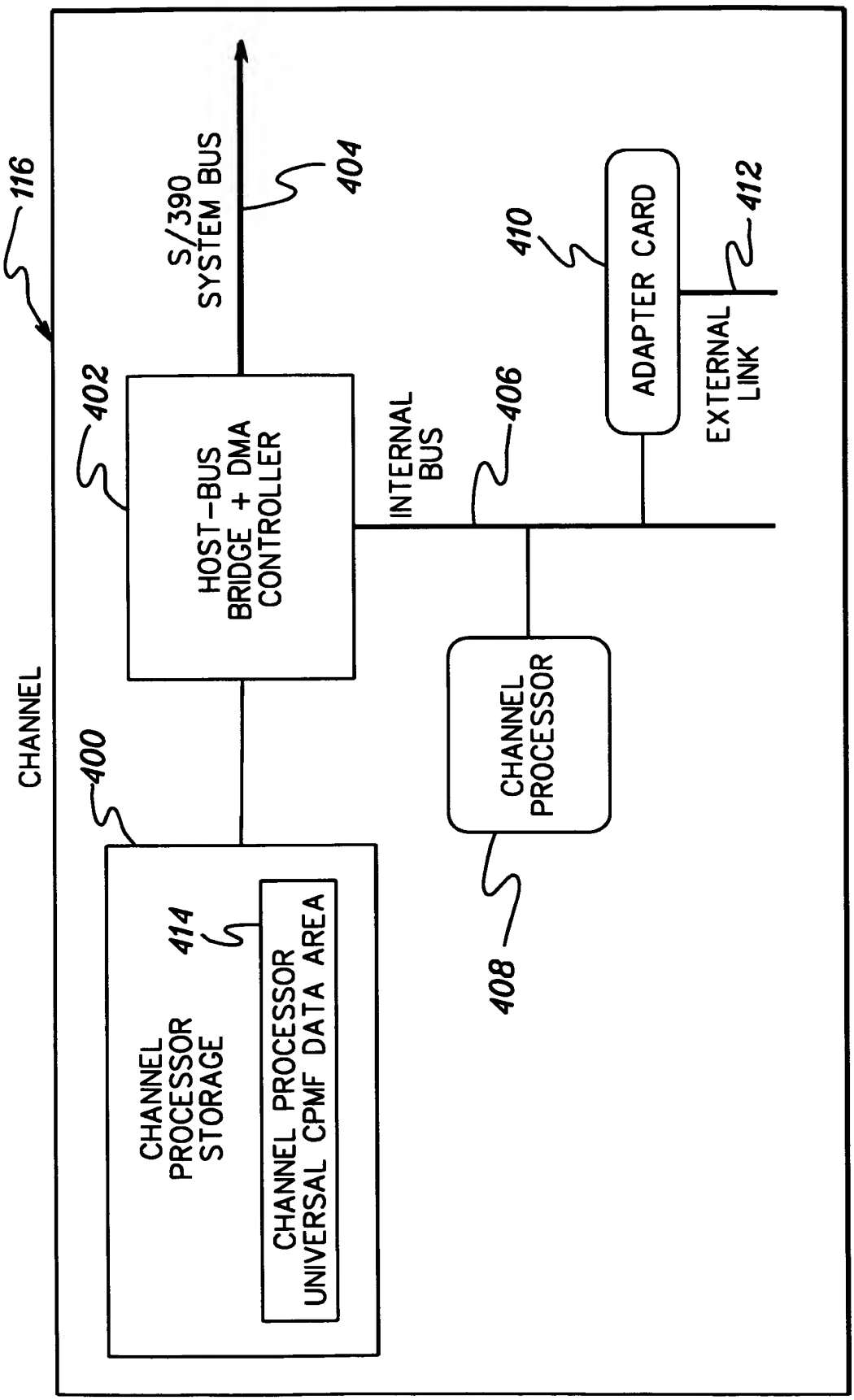
116
CHANNEL
S/390
SYSTEM BUS
404
402
HOST-BUS
BRIDGE + DMA
CONTROLLER
INTERNAL
BUS
406
410
ADAPTER CARD
412
EXTERNAL
LINK
400
CHANNEL
PROCESSOR
STORAGE
414
CHANNEL PROCESSOR
UNIVERSAL CPMF DATA AREA
CHANNEL
PROCESSOR
408

fig. 4

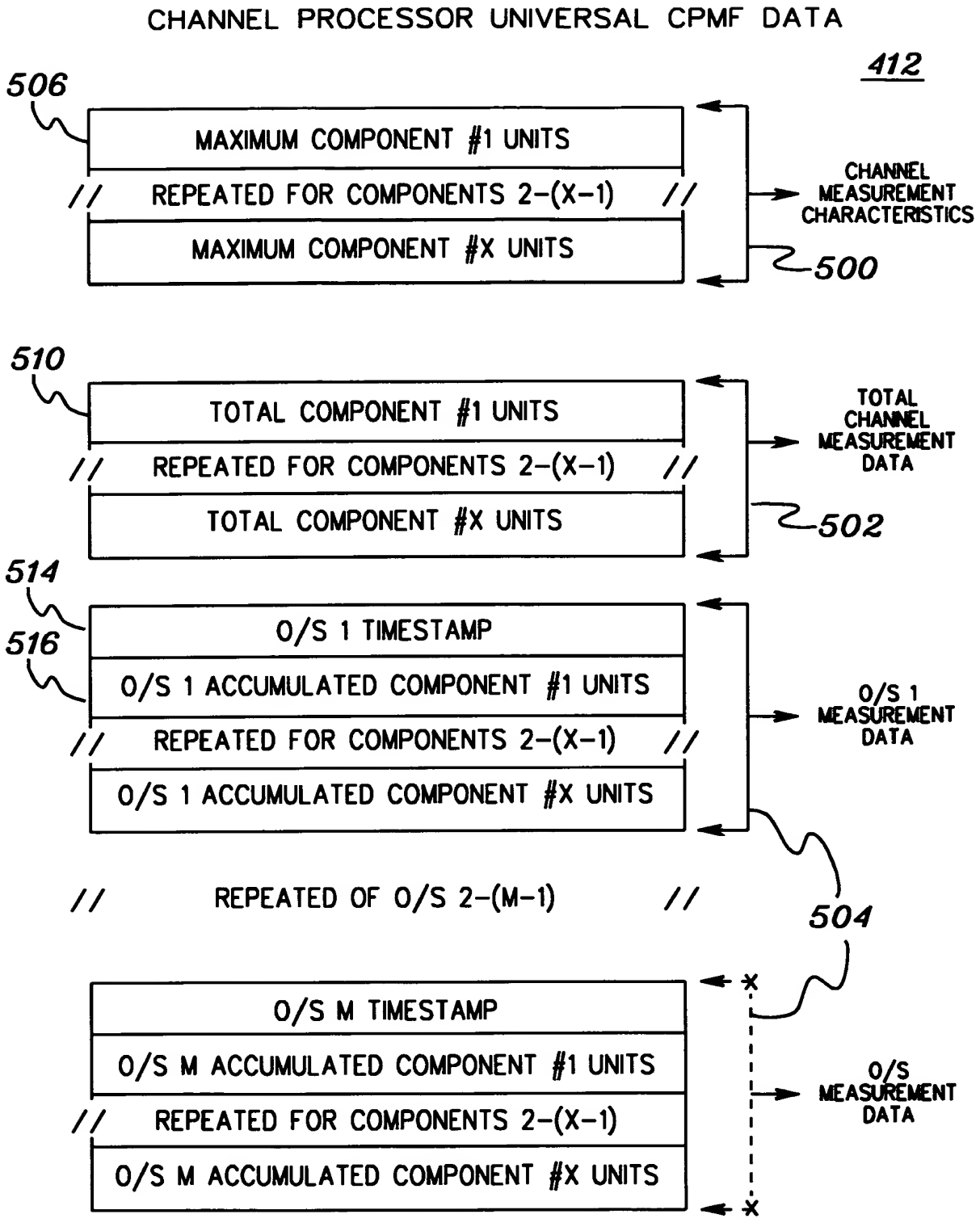
CHANNEL PROCESSOR UNIVERSAL CPMF DATA
412
506
MAXIMUM COMPONENT #1 UNITS
REPEATED FOR COMPONENTS 2-(X-1)
MAXIMUM COMPONENT #X UNITS
CHANNEL MEASUREMENT CHARACTERISTICS
500
510
TOTAL COMPONENT #1 UNITS
REPEATED FOR COMPONENTS 2-(X-1)
TOTAL COMPONENT #X UNITS
TOTAL CHANNEL MEASUREMENT DATA
502
514
516
O/S 1 TIMESTAMP
O/S 1 ACCUMULATED COMPONENT #1 UNITS
REPEATED FOR COMPONENTS 2-(X-1)
O/S 1 ACCUMULATED COMPONENT #X UNITS
O/S 1 MEASUREMENT DATA
REPEATED OF O/S 2-(M-1)
504
O/S M TIMESTAMP
O/S M ACCUMULATED COMPONENT #1 UNITS
REPEATED FOR COMPONENTS 2-(X-1)
O/S M ACCUMULATED COMPONENT #X UNITS
O/S MEASUREMENT DATA

fig. 5

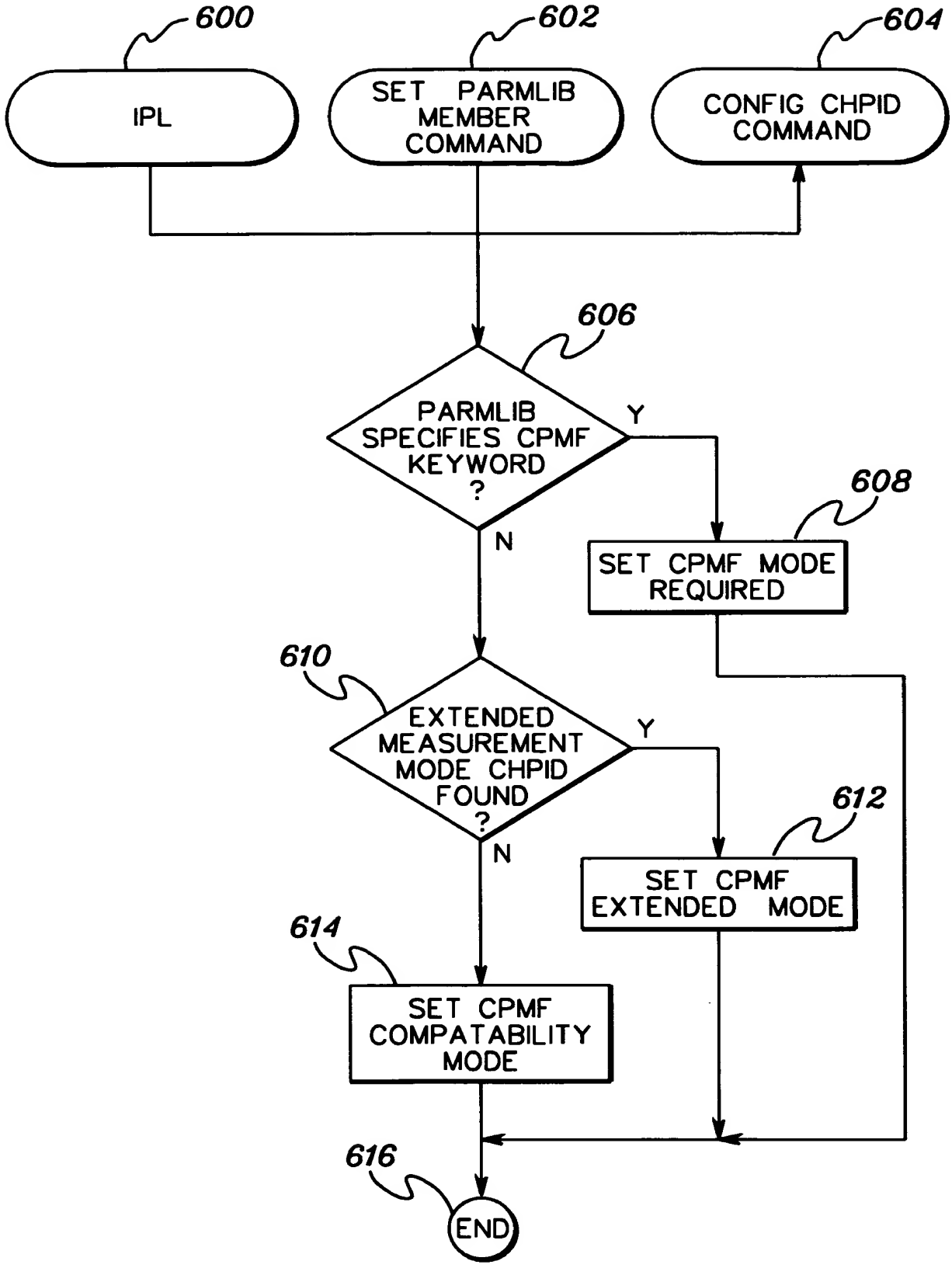
600
602
604
IPL
SET PARMLIB MEMBER COMMAND
CONFIG CHPID COMMAND
606
PARMLIB SPECIFIES CPMF KEYWORD ?
Y
N
608
SET CPMF MODE REQUIRED
610
EXTENDED MEASUREMENT MODE CHPID FOUND ?
Y
N
612
SET CPMF EXTENDED MODE
614
SET CPMF COMPATABILITY MODE
616
END

fig. 6

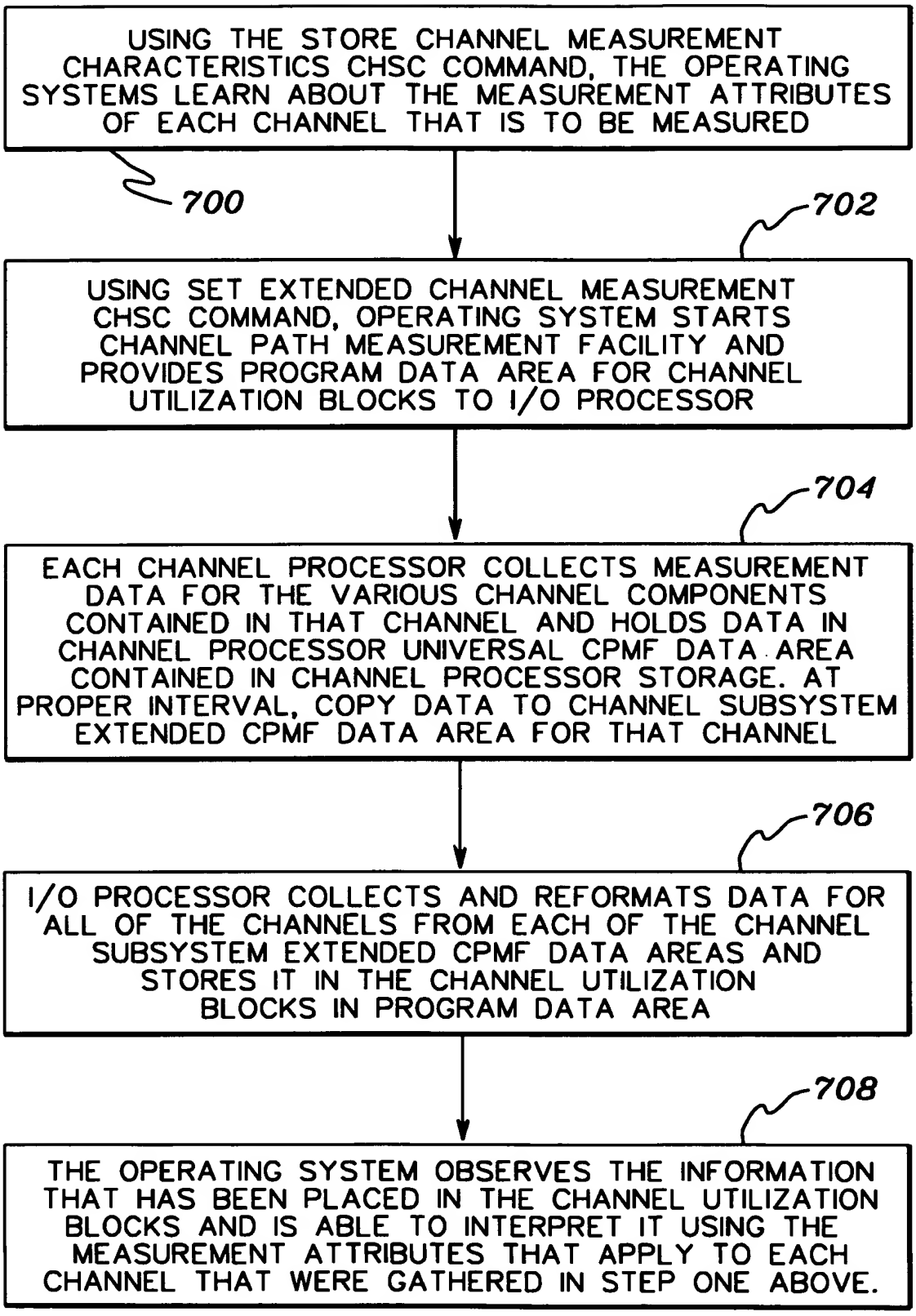
USING THE STORE CHANNEL MEASUREMENT CHARACTERISTICS CHSC COMMAND, THE OPERATING SYSTEMS LEARN ABOUT THE MEASUREMENT ATTRIBUTES OF EACH CHANNEL THAT IS TO BE MEASURED
700
USING SET EXTENDED CHANNEL MEASUREMENT CHSC COMMAND, OPERATING SYSTEM STARTS CHANNEL PATH MEASUREMENT FACILITY AND PROVIDES PROGRAM DATA AREA FOR CHANNEL UTILIZATION BLOCKS TO I/O PROCESSOR
702
EACH CHANNEL PROCESSOR COLLECTS MEASUREMENT DATA FOR THE VARIOUS CHANNEL COMPONENTS CONTAINED IN THAT CHANNEL AND HOLDS DATA IN CHANNEL PROCESSOR UNIVERSAL CPMF DATA AREA CONTAINED IN CHANNEL PROCESSOR STORAGE. AT PROPER INTERVAL, COPY DATA TO CHANNEL SUBSYSTEM EXTENDED CPMF DATA AREA FOR THAT CHANNEL
704
I/O PROCESSOR COLLECTS AND REFORMATS DATA FOR ALL OF THE CHANNELS FROM EACH OF THE CHANNEL SUBSYSTEM EXTENDED CPMF DATA AREAS AND STORES IT IN THE CHANNEL UTILIZATION BLOCKS IN PROGRAM DATA AREA
706
THE OPERATING SYSTEM OBSERVES THE INFORMATION THAT HAS BEEN PLACED IN THE CHANNEL UTILIZATION BLOCKS AND IS ABLE TO INTERPRET IT USING THE MEASUREMENT ATTRIBUTES THAT APPLY TO EACH CHANNEL THAT WERE GATHERED IN STEP ONE ABOVE.
708

fig. 7

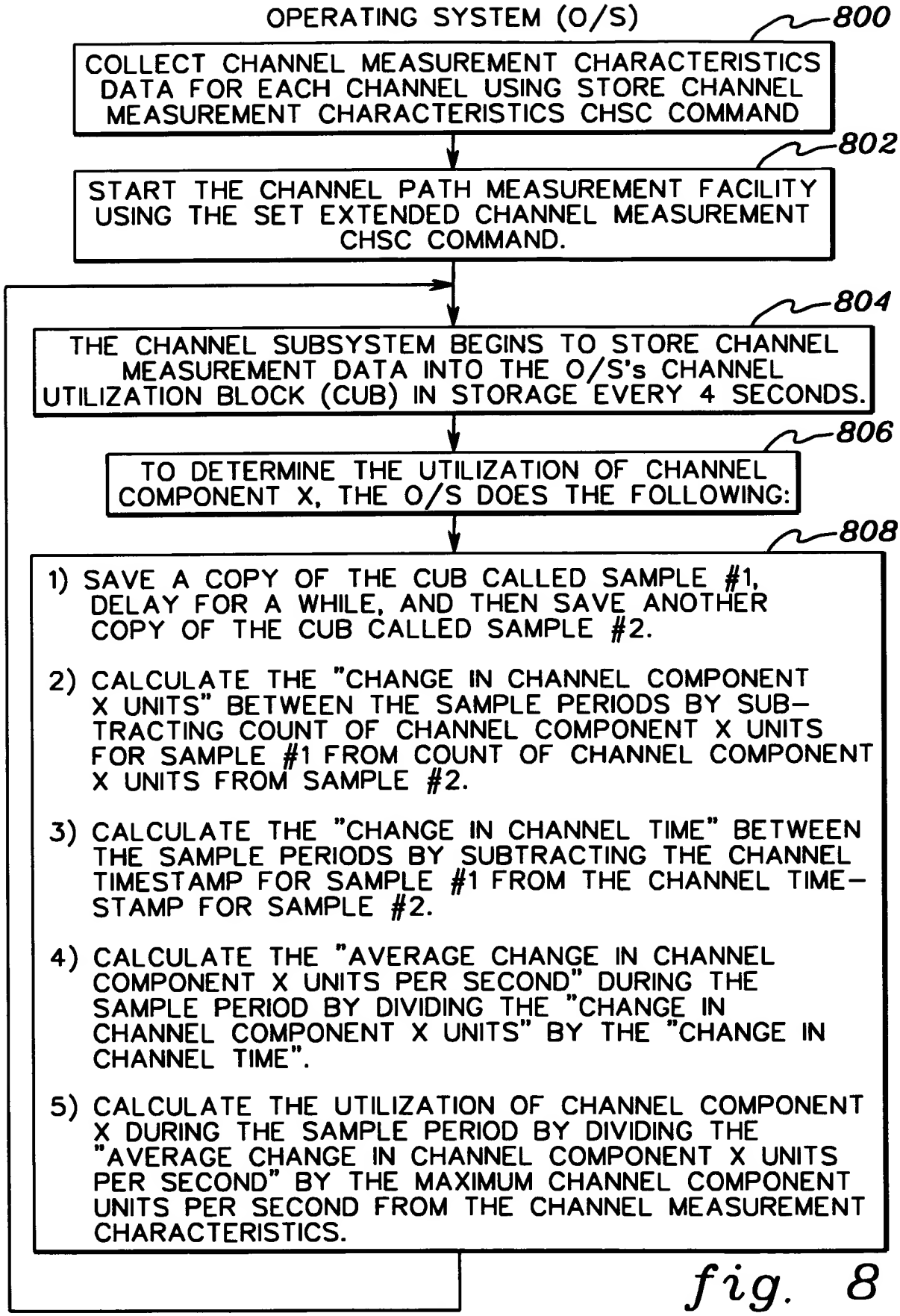
OPERATING SYSTEM (O/S)
800
COLLECT CHANNEL MEASUREMENT CHARACTERISTICS DATA FOR EACH CHANNEL USING STORE CHANNEL MEASUREMENT CHARACTERISTICS CHSC COMMAND
802
START THE CHANNEL PATH MEASUREMENT FACILITY USING THE SET EXTENDED CHANNEL MEASUREMENT CHSC COMMAND.
804
THE CHANNEL SUBSYSTEM BEGINS TO STORE CHANNEL MEASUREMENT DATA INTO THE O/S's CHANNEL UTILIZATION BLOCK (CUB) IN STORAGE EVERY 4 SECONDS.
806
TO DETERMINE THE UTILIZATION OF CHANNEL COMPONENT X, THE O/S DOES THE FOLLOWING:
808
1) SAVE A COPY OF THE CUB CALLED SAMPLE #1, DELAY FOR A WHILE, AND THEN SAVE ANOTHER COPY OF THE CUB CALLED SAMPLE #2.
2) CALCULATE THE "CHANGE IN CHANNEL COMPONENT X UNITS" BETWEEN THE SAMPLE PERIODS BY SUBTRACTING COUNT OF CHANNEL COMPONENT X UNITS FOR SAMPLE #1 FROM COUNT OF CHANNEL COMPONENT X UNITS FROM SAMPLE #2.
3) CALCULATE THE "CHANGE IN CHANNEL TIME" BETWEEN THE SAMPLE PERIODS BY SUBTRACTING THE CHANNEL TIMESTAMP FOR SAMPLE #1 FROM THE CHANNEL TIMESTAMP FOR SAMPLE #2.
4) CALCULATE THE "AVERAGE CHANGE IN CHANNEL COMPONENT X UNITS PER SECOND" DURING THE SAMPLE PERIOD BY DIVIDING THE "CHANGE IN CHANNEL COMPONENT X UNITS" BY THE "CHANGE IN CHANNEL TIME".
5) CALCULATE THE UTILIZATION OF CHANNEL COMPONENT X DURING THE SAMPLE PERIOD BY DIVIDING THE "AVERAGE CHANGE IN CHANNEL COMPONENT X UNITS PER SECOND" BY THE MAXIMUM CHANNEL COMPONENT UNITS PER SECOND FROM THE CHANNEL MEASUREMENT CHARACTERISTICS.

fig. 8

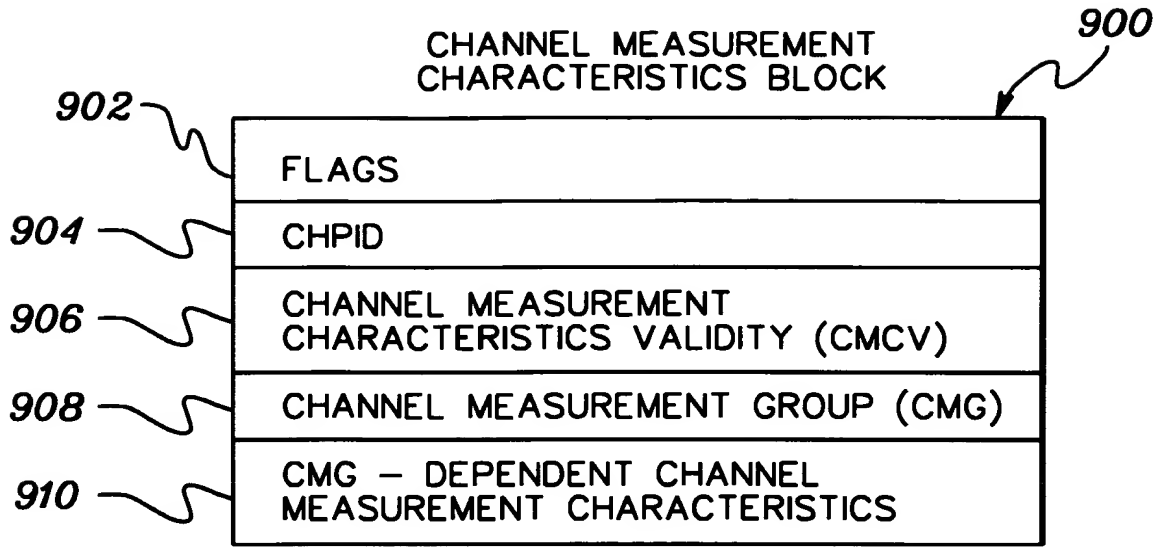

fig. 9A

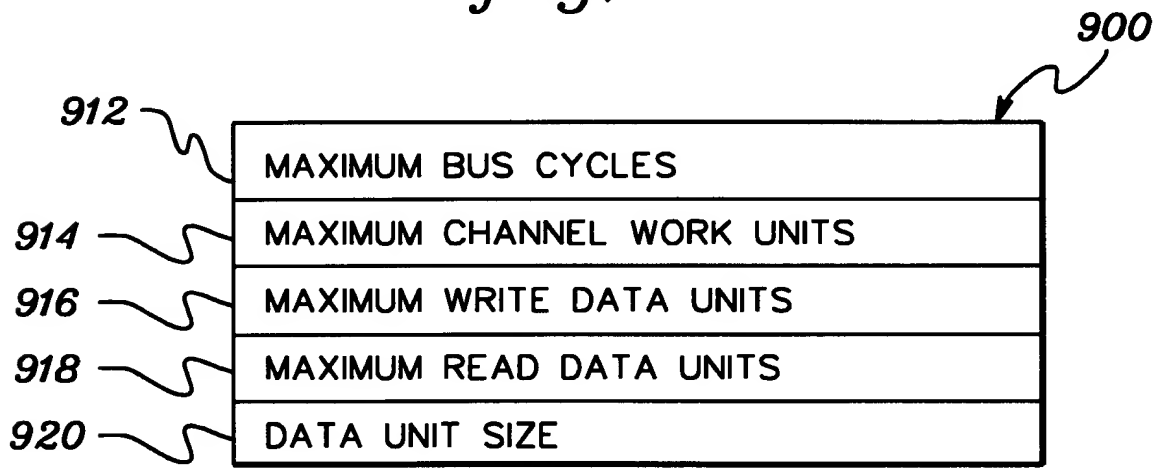

fig. 9B

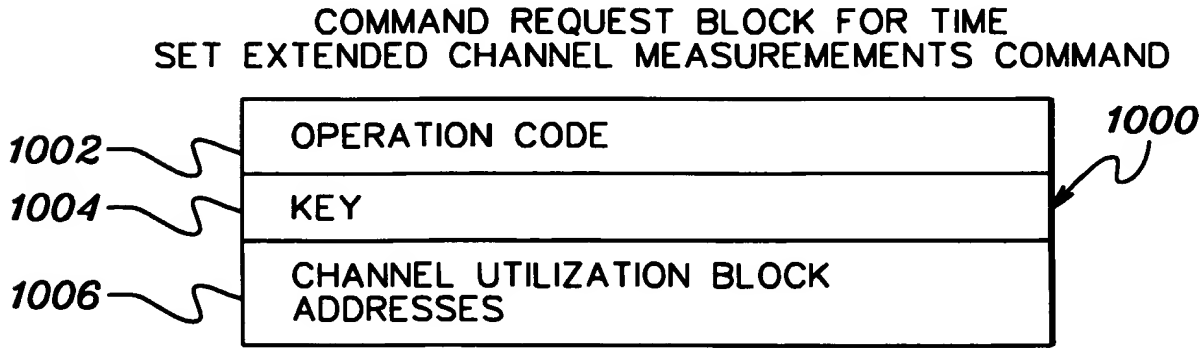

fig. 10

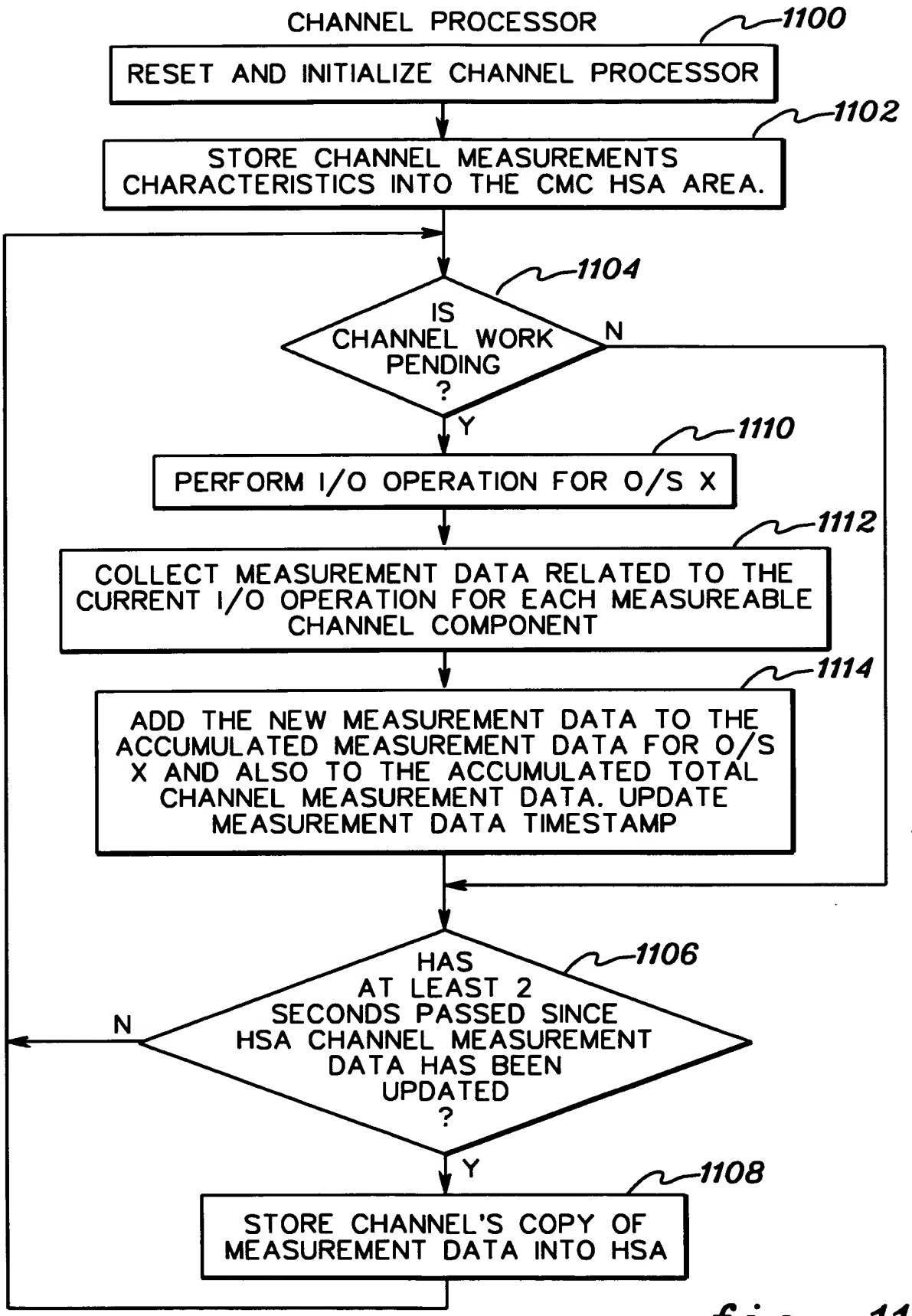
CHANNEL PROCESSOR
1100
RESET AND INITIALIZE CHANNEL PROCESSOR
1102
STORE CHANNEL MEASUREMENTS CHARACTERISTICS INTO THE CMC HSA AREA.
1104
IS CHANNEL WORK PENDING ?
N
Y
1110
PERFORM I/O OPERATION FOR O/S X
1112
COLLECT MEASUREMENT DATA RELATED TO THE CURRENT I/O OPERATION FOR EACH MEASUREABLE CHANNEL COMPONENT
1114
ADD THE NEW MEASUREMENT DATA TO THE ACCUMULATED MEASUREMENT DATA FOR O/S X AND ALSO TO THE ACCUMULATED TOTAL CHANNEL MEASUREMENT DATA. UPDATE MEASUREMENT DATA TIMESTAMP
1106
HAS AT LEAST 2 SECONDS PASSED SINCE HSA CHANNEL MEASUREMENT DATA HAS BEEN UPDATED ?
N
Y
1108
STORE CHANNEL'S COPY OF MEASUREMENT DATA INTO HSA

fig. 11

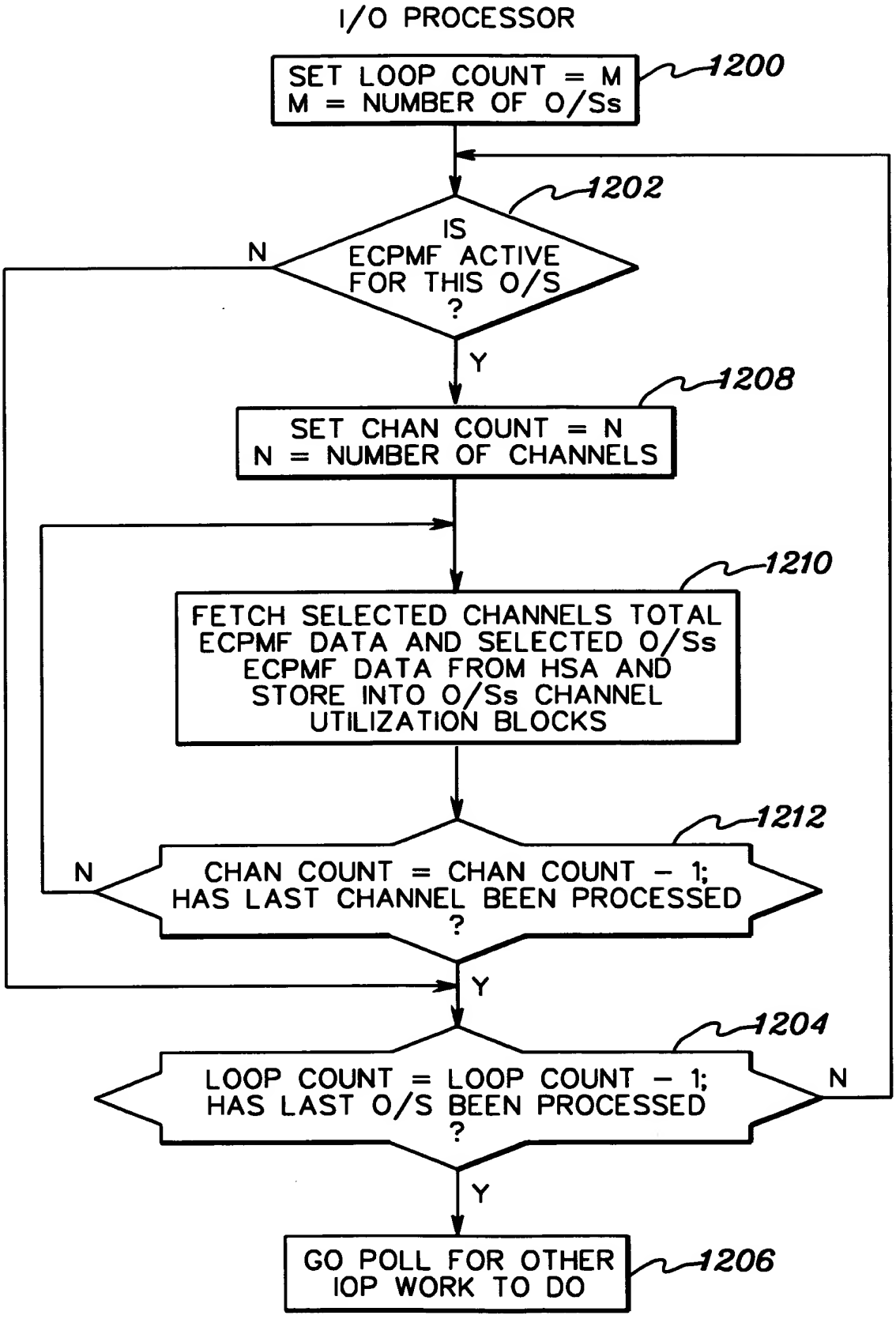
I/O PROCESSOR
SET LOOP COUNT = M
M = NUMBER OF O/Ss
1200
1202
IS
ECPMF ACTIVE
FOR THIS O/S
?
N
Y
1208
SET CHAN COUNT = N
N = NUMBER OF CHANNELS
1210
FETCH SELECTED CHANNELS TOTAL
ECPMF DATA AND SELECTED O/Ss
ECPMF DATA FROM HSA AND
STORE INTO O/Ss CHANNEL
UTILIZATION BLOCKS
1212
CHAN COUNT = CHAN COUNT - 1;
HAS LAST CHANNEL BEEN PROCESSED
?
N
Y
1204
LOOP COUNT = LOOP COUNT - 1;
HAS LAST O/S BEEN PROCESSED
?
N
Y
GO POLL FOR OTHER
IOP WORK TO DO
1206

fig. 12